Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **October/November 2019**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Abbreviations

cao correct answer only
dep dependent
FT follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
nfww not from wrong working
soi seen or implied

Question	Answer	Marks	Partial Marks
1(a)	16	**2**	**M1** for $\frac{406-350}{350}[\times 100]$ or $\frac{406}{350}\times 100$ After 0 scored, **SC1** for answer 84
1(b)	No, maximum possible mass is 23.25 kg	**2**	**B1** for 15.5 + 0.25 or 1.2 + 0.05 used or **M1** for *their* 15.75 + 6 × *their* 1.25
1(c)	72[.00] final answer	**3**	**M1** for 245 × 0.73 **M1** for $\frac{\textit{their}178.85-124}{0.76}$ oe
1(d)	36.44	**3**	**M1** for $\frac{657}{100}\times 4.3$ **M1** for *their* 28.251×1.29
1(e)	115 805 32.75 131 936 996.84	**4**	**B1** for 115 **M1** for $\frac{100+6.5}{100}x=996.84$ soi **A1** for 936 **B1FT** for 32.75 or dinner cost = (*their* 936 – 805) ÷ 4
2(a)(i)	Correct histogram with frequency density axis scaled	**3**	**B1** for 4 or more rectangles on correct bases **B1** for 4 or more correct frequency densities soi
2(a)(ii)	49	**2**	**M1** for 56 + 24 + 18 soi
2(b)(i)	2	**1**	
2(b)(ii)	2.63	**2**	**M1** for ([0 × 17] + 1 × 47 + 2 × 42 + 3 × 28 + 4 × 32 + 5 × 21 + 6 × 13) ÷ 200 oe
2(b)(iii)	$\frac{34}{200}$ oe	**1**	

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Question	Answer	Marks	Partial Marks
2(b)(iv)	0.1222 final answer	**3**	**M2** for $2\times\frac{13}{200}\times\frac{187}{199}$ oe or **M1** for $\frac{k}{200}\times\frac{200-k}{199}[\times 2]$ oe where $0 < k < 200$ If 0 scored, **SC1** for $2\times\frac{13\times187}{200^2}$ oe
3(a)	Centre (7, 1), scale factor 2	**2**	**B1** for each
3(b)	Correct rotation, vertices (3, 0), (4, 0), (4, –2), (3, –1)	**2**	**B1** for correct size and orientation but wrong position or **SC1** for correct anticlockwise rotation about (1, 0) vertices (–1, 0), (–2, 0), (–1, 1), (–2, 2)
3(c)(i)	Correct transformation, vertices (–2, –1),(–3, –1), (–3, –3), (–2, –2)	**2**	**B1** for three vertices correct or three correct pairs of coordinates soi
3(c)(ii)	Reflection in $y = -x$ oe	**2**	**B1** for reflection **B1** for $y = -x$ oe
4(a)	5030 or 5026 or 5027 or 5026.5 to 5027.2	**3**	**M1** for $\frac{1}{3}\pi\times4^2\times15$ **M1** for $\pi\times4^2\times95$ After 0 scored, **SC1** for answer 20 100 or 20 110 or 20 106 to 20 109
4(b)	$[l =]\sqrt{15^2+4^2}\left(=\sqrt{241}\right)$	**M2**	**M1** for $[l^2 =]\ 15^2 + 4^2$ oe
	Curved surface area $=4\pi\times\sqrt{241}+\pi\times8\times95$	**M2**	**M1** for $4\pi\times their\sqrt{241}$ or $\pi\times8\times95$
	=2582.3 to 2583.03=2580 **AG**	**A1**	
4(c)	4800 or 4797.5 to 4803.2	**2**	**M1** for $\left(\frac{150}{95+15}\right)^2$ or $\left(\frac{95+15}{150}\right)^2$ soi
5(a)(i)	$[a =]$ 3.5 oe $[b =]$ –25.25	**2**	**B1** for $(x + 3.5)^2$ or $a = 3.5$
5(a)(ii)	$x = -3.5 \pm \sqrt{25.25}$	**M1**	**FT** *their* completed square expression
	1.52 –8.52	**A1**	After 0 scored, **B1** for 1.52 and –8.52
5(b)	$\frac{2x+3}{x-4}$ final answer nfww	**3**	**B1** for $(2x + 3)(2x – 3)$ oe factorisation seen **B1** for $(2x – 3)(x – 4)$ oe factorisation seen

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Question	Answer	Marks	Partial Marks
5(c)	$x = 16$	**4**	**M1** for $2x(x-1) + 6(x+4) = 2(x+4)(x-1)$ **M1FT** for $2x^2 - 2x + 6x + 24 = 2x^2 + 8x - 2x - 8$ **M1FT** for $24 + 8 = 6x - 4x$ (may be $8x - 6x$)
6(a)	24 35	**1**	
6(b)	$n(n+2)$ oe	**2**	**B1** for quadratic expression in n
6(c)(i)	35	**3**	**B2** for 35×37 or 35.8 to 35.9 OR **M1** for *their* $n(n+2) = 1358$ **M1** for solution of *their* quadratic $\frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times (-1358)}}{2 \times 1}$
6(c)(ii)	7	**2**	**M1FT** for 1358–*their* **(c)(i)** × (*their* **(c)(i)** + 2)
7(a)	$\angle PXQ = \angle SXR$, vertically opposite $\angle QPX = \angle RSX$, angles in same segment $\angle PQX = \angle SRX$, angles in same segment Hence similar	**3**	**B1** for two correct pairs of angles identified **B1** for correct reasons for two pairs of angles
7(b)(i)	3.5	**2**	**M1** for $\frac{RX}{6.3} = \frac{4.5}{8.1}$ oe
7(b)(ii)	7 : 5 nfww	**2**	**B1** for 6.3 : 4.5 oe nfww
8(a)	$x - 4$	**1**	
8(b)	CB = area ÷ length = $\frac{80}{x}$ and $CQ = CB - 4$ oe	**1**	
8(c)	$[y =] 80 - \frac{1}{2}(x-4)\left(\frac{80}{x} - 4\right)$	**M1**	**FT** *their* expression from **(a)**
	$80 - \frac{320}{x} - 4x + 16$	**M1**	**FT** *their* expression from **(a)** of the form $ax + b$
	Correct working leading to $y = 32 + 2x + \frac{160}{x}$ **AG**	**A1**	
8(d)	74	**1**	
8(e)	Correct smooth curve	**3**	**B2FT** for 8 or 9 points correctly plotted or **B1FT** for 6 or 7 points correctly plotted
8(f)	67.4 up to but not including 68	**1**	

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Question	Answer	Marks	Partial Marks
9(a)	$\cos B\hat{A}C = \frac{950^2 + 520^2 - 680^2}{2 \times 950 \times 520}$	**M2**	or **M1** for $680^2 = 950^2 + 520^2 - 2 \times 950 \times 520 \times \cos B\hat{A}C$ oe
	$B\hat{A}C$ = 44.01 to 44.02 [= 44.0°]	**A1**	
9(b)	349	**1**	
9(c)	4 min 53 s	**4**	**M2** for [distance =]520 cos44 or **M1** for $\cos 44 = \frac{d}{520}$ oe AND **M1** for *their* distance ÷ 4.6
9(d)	14.8° or 14.78 to 14.79	**4**	**M2** for $h = 950 \tan 10.7$ oe or **M1** for $\tan 10.7 = \frac{h}{950}$ oe AND **M1** for $\tan[\ ] = \frac{their\ h}{680}$ oe
10(a)	10.6[3…]	**2**	**M1** for $\sqrt{(3--4)^2 + (5--3)^2}$ oe
10(b)	Gradient = $-\frac{1}{3}$ oe	**M1**	
	Substitutes pair of values into $y = their\left(-\frac{1}{3}\right)x + c$ to find c	**M1**	
	$y = -\frac{1}{3}x + \frac{1}{3}$ oe rearranged to $3y + x = 1$ **AG**	**A1**	
10(c)	[y =] $3x + 9$	**3**	**B1** for gradient = 3 soi **M1** for substituting (–4, –3) into $y = their\ 3x + c$

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